IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/8/20

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background
IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/8/20 11 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

IEM's Modeling Lead
Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Florida State Projections
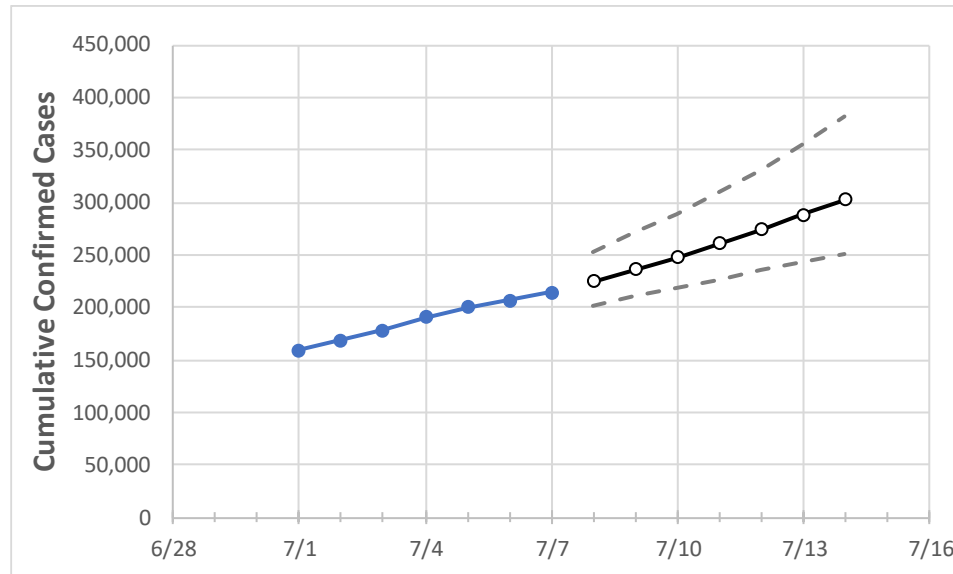
	Actual Confirmed Cases On:				Projected Cases For:						
	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14
Florida	190,052	200,111	206,447	213,794	224,572	235,935	247,919	260,557	273,888	287,950	302,784

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 20%, and are often within 10%, of actual confirmed cases.

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14
Alachua	1,506	1,578	1,636	1,701	1,782	1,866	1,955	2,047	2,143	2,244	2,350
Broward	19,575	21,239	21,856	22,595	23,749	24,989	26,321	27,752	29,289	30,938	32,710
Charlotte	887	922	935	944	972	1,001	1,032	1,064	1,098	1,134	1,172
Collier	4,880	5,019	5,076	5,201	5,339	5,480	5,625	5,772	5,923	6,078	6,236
Duval	8,614	9,146	9,487	9,835	10,277	10,875	11,452	12,066	12,590	13,143	13,691
Hillsborough	13,700	14,336	14,677	15,362	16,086	16,834	17,608	18,408	19,236	20,092	20,978
Lake	1,694	1,845	1,890	1,998	2,115	2,239	2,370	2,510	2,659	2,817	2,984
Lee	7,215	7,498	7,661	7,859	8,213	8,586	8,981	9,398	9,838	10,303	10,794
Manatee	3,554	3,716	3,785	3,890	4,025	4,164	4,308	4,458	4,612	4,772	4,937
Miami-Dade	44,729	47,011	48,992	51,058	53,268	55,328	57,401	59,742	61,985	64,296	66,462
Okaloosa	880	906	917	938	979	1,023	1,068	1,116	1,166	1,218	1,273
Orange	13,262	14,032	14,407	14,768	15,394	16,033	16,685	17,350	18,029	18,721	19,427
Osceola	2,781	2,966	3,068	3,190	3,303	3,469	3,656	3,840	4,021	4,188	4,346
Palm Beach	16,149	16,836	17,242	17,638	18,188	18,755	19,341	19,945	20,569	21,212	21,876
Pasco	2,608	2,757	2,850	3,004	3,186	3,356	3,510	3,650	3,803	3,946	4,114
Pinellas	8,116	8,533	8,759	9,032	9,420	9,819	10,229	10,651	11,084	11,529	11,987
Polk	4,906	5,196	5,472	5,665	5,926	6,214	6,501	6,750	7,000	7,294	7,538
Sarasota	2,059	2,160	2,191	2,249	2,346	2,449	2,557	2,670	2,789	2,915	3,047
Seminole	3,205	3,339	3,430	3,522	3,667	3,814	3,963	4,112	4,263	4,416	4,570
St. Johns	1,259	1,325	1,383	1,433	1,519	1,611	1,708	1,811	1,920	2,035	2,158
Sumter	408	420	436	478	502	522	540	559	577	597	617
Volusia	2,604	2,685	2,804	2,951	3,101	3,260	3,428	3,606	3,794	3,993	4,205

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

Florida Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	7/4	7/5	7/6	7/7	7/9	7/11	7/13
Alachua	1,506	1,578	1,636	1,701	1,866 (373) [90] {45}	2,047 (409) [98] {49}	2,244 (449) [108] {54}
Broward	19,575	21,239	21,856	22,595	24,989 (4,998) [1,199] {600}	27,752 (5,550) [1,332] {666}	30,938 (6,188) [1,485] {743}
Charlotte	887	922	935	944	1,001 (200) [48] {24}	1,064 (213) [51] {26}	1,134 (227) [54] {27}
Collier	4,880	5,019	5,076	5,201	5,480 (1,096) [263] {132}	5,772 (1,154) [277] {139}	6,078 (1,216) [292] {146}
Duval	8,614	9,146	9,487	9,835	10,875 (2,175) [522] {261}	12,066 (2,413) [579] {290}	13,143 (2,629) [631] {315}
Hillsborough	13,700	14,336	14,677	15,362	16,834 (3,367) [808] {404}	18,408 (3,682) [884] {442}	20,092 (4,018) [964] {482}
Lake	1,694	1,845	1,890	1,998	2,239 (448) [107] {54}	2,510 (502) [120] {60}	2,817 (563) [135] {68}
Lee	7,215	7,498	7,661	7,859	8,586 (1,717) [412] {206}	9,398 (1,880) [451] {226}	10,303 (2,061) [495] {247}
Manatee	3,554	3,716	3,785	3,890	4,164 (833) [200] {100}	4,458 (892) [214] {107}	4,772 (954) [229] {115}
Miami-Dade	44,729	47,011	48,992	51,058	55,328 (11,066) [2,656] {1,328}	59,742 (11,948) [2,868] {1,434}	64,296 (12,859) [3,086] {1,543}
Okaloosa	880	906	917	938	1,023 (205) [49] {25}	1,116 (223) [54] {27}	1,218 (244) [58] {29}
Orange	13,262	14,032	14,407	14,768	16,033 (3,207) [770] {385}	17,350 (3,470) [833] {416}	18,721 (3,744) [899] {449}
Osceola	2,781	2,966	3,068	3,190	3,469 (694) [167] {83}	3,840 (768) [184] {92}	4,188 (838) [201] {101}
Palm Beach	16,149	16,836	17,242	17,638	18,755 (3,751) [900] {450}	19,945 (3,989) [957] {479}	21,212 (4,242) [1,018] {509}
Pasco	2,608	2,757	2,850	3,004	3,356 (671) [161] {81}	3,650 (730) [175] {88}	3,946 (789) [189] {95}
Pinellas	8,116	8,533	8,759	9,032	9,819 (1,964) [471] {236}	10,651 (2,130) [511] {256}	11,529 (2,306) [553] {277}
Polk	4,906	5,196	5,472	5,665	6,214 (1,243) [298] {149}	6,750 (1,350) [324] {162}	7,294 (1,459) [350] {175}
Sarasota	2,059	2,160	2,191	2,249	2,449 (490) [118] {59}	2,670 (534) [128] {64}	2,915 (583) [140] {70}
Seminole	3,205	3,339	3,430	3,522	3,814 (763) [183] {92}	4,112 (822) [197] {99}	4,416 (883) [212] {106}
St. Johns	1,259	1,325	1,383	1,433	1,611 (322) [77] {39}	1,811 (362) [87] {43}	2,035 (407) [98] {49}
Sumter	408	420	436	478	522 (104) [25] {13}	559 (112) [27] {13}	597 (119) [29] {14}
Volusia	2,604	2,685	2,804	2,951	3,260 (652) [156] {78}	3,606 (721) [173] {87}	3,993 (799) [192] {96}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.